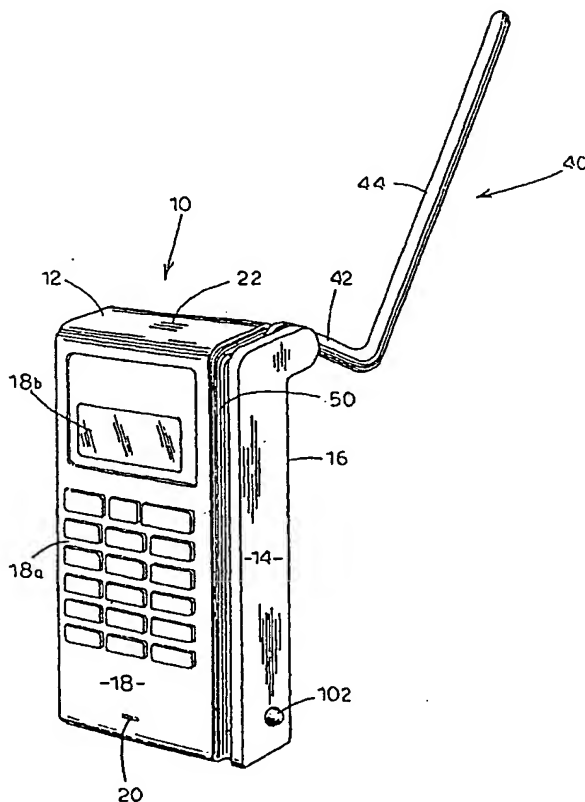


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**(54) Title:** MOBILE TELEPHONE HAVING A FOLDING ANTENNA**(57) Abstract**

A mobile telephone having a movably mounted antenna and speaker. The mobile telephone includes a housing structure having a top, a pair of sides, back and a front panel including a keypad area and a display. Formed about a top portion of the telephone is a transverse axis. Rotatably mounted in coaxial relationship to the transverse axis is an L-shaped antenna and a speaker unit. In a retracted position, both the antenna and the speaker unit assume a retracted position where the speaker is disposed adjacent the front panel of the telephone while the antenna overlies the speaker. In an extended position, both the antenna and the speaker unit are moved away from the front panel of the telephone and the speaker unit is normally disposed inwardly of the antenna.



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# **MOBILE TELEPHONE HAVING A FOLDING ANTENNA**

## **FIELD OF THE INVENTION**

The present invention relates to telephones and more particularly to mobile telephones having antennas and/or speakers that are movably mounted about the housing of the telephone.

## **BACKGROUND OF THE INVENTION**

More than any other factor, consumer demand for lightweight and compact cellular telephones has driven the mobile telephone industry to continually reduce the size of the electronic hardware associated with these handheld phones in order that the size of the overall phone package may also be reduced accordingly. While such lightweight and compact phones may be easily carried on the user's person as a result of the reduced physical size, it is sometimes the case that the ease of operation of the resulting compact phone unit is impaired. In particular, the antenna traditionally employed on such compact cellular telephones is often required to be positioned so close to the user's head during operation that it can affect the efficiency of the antenna itself and impair the user's ability to easily handle the phone. While typical cellular phones employ either a rigid telescoping antenna or a flexible fixed length antenna, such antennas are still disposed in close proximity to the user's head during use, and therefore can interfere with the user's ability to easily operate the phone.

In addition to the above concerns, the small physical size of the cellular telephone unit can also present concerns with regard to the relative positioning of the speaker and microphone of the phone. More particularly,

the desire to produce a phone unit that is small and physically compact often results in a phone which has a relatively short separation or distance between the speaker and the microphone. In some cases, the speaker to microphone separation can be so small that the phone is difficult to use. That is, the speaker and microphone are positioned so close to one another that it is difficult for the ear and mouth of a user to be positioned sufficiently close to the speaker and microphone such that audio can be clearly transmitted between the user and the phone.

Therefore, there continues to be a need for a practical, cost effective cellular or mobile phone which is lightweight and physically compact, and which further provides an overall phone design where the antenna does not interfere with the use of the phone and wherein the effective distance between the speaker and microphone can be extended in order to position the speaker and microphone closer to the user's ear and mouth respectively.

### **SUMMARY OF THE INVENTION**

The present invention entails a mobile telephone having a movable antenna and speaker. In one embodiment, the telephone is provided with a folding antenna that is movable back and forth between a retracted position where the antenna lies closely adjacent to the housing of the telephone and an extended position where the antenna projects outwardly away from the telephone housing. In another embodiment, the telephone includes a movable speaker that moves between a retracted position where the speaker is disposed adjacent the telephone housing and an extended position where the speaker extends outwardly away from the housing and the distance between the speaker and the microphone is increased.

In one particular embodiment of the present invention, the telephone includes both a movable speaker and antenna. Here the speaker and antenna are coaxially mounted about a transverse pivot axis that is disposed about an upper or top portion of a telephone. Both the speaker and antenna rotate about the pivot axis and are movable between retracted and extended positions. In the retracted position, both the speaker and antenna fold against the front or keyboard area of the telephone, with the speaker itself being sandwiched between the front panel of the telephone housing and the antenna which in this embodiment may include a generally planar or panel type antenna. When extended, the speaker and antenna are rotated from the retracted position where the speaker assumes an intermediate position between the front of the telephone housing and the antenna while the antenna is further rotated away from the speaker such that there are angular separations between the front of the telephone housing, the speaker and the antenna.

More particularly, in one design, the antenna assumes a generally L-shaped configuration and includes first and second legs. In this case, the pivot axis is disposed across the top-back edge portion of the telephone housing. In the retracted position, the L-shaped antenna is folded back against the telephone housing such that the first leg overlies a top portion of the housing while the second leg overlies a portion of the front of the telephone housing. As suggested above, in this case, a movable speaker can be provided and when the antenna is disposed in the retracted position, the speaker would assume a position underneath a portion of the antenna.

Finally, in another embodiment of the present invention, the mobile telephone is provided with a speaker that is movable generally rectilinearly between retracted and extended positions. In this case, when the speaker assumes a retracted position it lies within the general confines of the telephone housing as a whole. However, when the speaker is moved to an extended position the speaker tends to project up and outwardly from the confines of the telephone housing.

It is therefore an object of the present invention to provide a small and physically compact mobile telephone with an efficient antenna that does not substantially impair the use of the telephone.

Another object of the present invention is to provide a small and physically compact mobile telephone with a movable speaker that permits the distance between a microphone associated with the telephone and the speaker to be extended such that the speaker and the microphone can be positioned closer to the mouth and ear of the user of the telephone.

Other objects and advantages of the present invention will become apparent and obvious from a study of the following description and the accompanying drawings which are merely illustrative of such invention.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is a perspective view of the mobile telephone of the present invention with the antenna disposed in an extended position.

Figure 2 is a perspective view of the mobile telephone with the antenna disposed in a folded and retracted position.

Figures 2A-2C are a series of schematic illustrations showing an antenna latch for securing the antenna to the housing of the cellular telephone design shown in Figures 1 and 2.

Figure 3 is a perspective view of a second embodiment of the mobile telephone of the present invention with the antenna assuming a generally planar configuration and disposed in the folded and retracted position.

Figure 4 is a perspective view of the mobile telephone shown in Figure 3 but with the antenna disposed in an extended position.

Figures 5 and 6 illustrate another embodiment of the present invention, this embodiment illustrating a mobile telephone having a speaker that moves vertically up and down between retracted and extended positions.

Figure 7 is a perspective view of another embodiment of the mobile telephone of the present invention, this embodiment illustrating a speaker and a planar antenna, both coaxially mounted about a transverse pivot axis that extends across the top portion of the telephone.

Figure 8 is a fragmentary side elevational view of the telephone shown in Figure 7 with certain portions of the antenna shown in section and with both the antenna and speaker being disposed in a folded and retracted position.

Figure 9 is a fragmentary side elevational view similar to that shown in Figure 8 but with the antenna being rotated to a partially open or extended position.

Figure 10 is a fragmentary side elevational view similar to Figures 8 and 9 but with the antenna rotated to its fully extended position and the speaker being rotated to a partially open or extended position.

Figure 11 is a fragmentary side elevational view similar to Figures 8, 9 and 10 but with both the antenna and speaker being rotated to the extended positions.

### **DESCRIPTION OF THE INVENTION**

With further reference to the drawings, a mobile telephone of the cellular type is shown therein and indicated generally by the numeral 10. Telephone 10 includes a surrounding housing structure that includes a top 12, a pair of sides 14, a back 16, and a front panel 18. In conventional fashion, the front panel 18 includes a keypad area 18a and a display panel or area 18b.

Disposed about the lower portion of the telephone 10 is a microphone 20. In the case of the embodiments illustrated in Figures 1-6, a speaker 22 is also incorporated into the top portion of the telephone. Speaker 22 can be disposed such that the speaker grids formed in the housing appear on the top panel 12 of the telephone or about the upper portion of the front panel 18.

Cellular telephone 10 shown in Figures 1 and 2 includes a foldable antenna indicated generally by the numeral 40. Antenna 40 includes a first leg 42 and a second leg 44. Consequently, the antenna 40 shown in Figures 1 and 2 is of an L-shaped configuration with the legs 42 and 44 being generally elongated. Antenna 40 is rotatably mounted about a pivot axis that extends transversely across an upper portion of the telephone housing. In the case of



the design shown in Figures 1 and 2, the transverse pivot axis is disposed about the back edge portion of the top panel 12.

To house the antenna 40 when the same assumes a folded or retracted position, there is provided an L-shaped recessed antenna groove 50 formed about one side of the telephone 10. Note in Figure 1 where the recessed antenna groove 50 extends across one side portion of the top 12 and then downwardly along one side of the front panel 18. Groove 50 is designed such that the antenna 50 will fit therein when the antenna assumes the retracted position.

The antenna 40 can be retained within the antenna groove 50 by any number of conventional latch designs. Figures 2A-2C illustrate one antenna latch design, indicated generally by the numeral 100, that can be incorporated into the cellular telephone housing for retaining the antenna 40 when the same assumes the folded and stored position shown in Figure 2. Viewing the antenna latch 100 in more detail, the same includes a pivotally mounted finger actuated paw having an actuating button 102 and a retaining end paw 104. The actuating paw is pivotally mounted within the housing about a pivot pin 106. A spring is interposed between the actuating paw and the housing of the telephone for biasing the paw towards a retained position (Figure 2B). In the retained position, the leg 42 of the antenna is held within the antenna groove 50 by the paw end 104. To release the leg 42 of the antenna, the actuating button 102 is pressed inwardly towards the housing, which causes the actuating paw to rotate generally counterclockwise about the pivot pin 106. This causes the retaining paw 104 to be moved left to right as viewed in Figure 2C so as to release the leg 42 of the antenna. To latch the antenna in

place, the leg 42 is simply pushed or pressed into engagement with the terminal end of the retaining paw 104, as illustrated in Figure 2A. Because of the shape of the antenna and the shape of the terminal end of the retaining paw 104, the leg 42 of the antenna is effective to engage the retaining paw 104 and causes the same to be pushed from left to right in Figure 2A, enabling the antenna leg 42 to be pushed into the antenna groove 50 where the retaining paw 104 will engage and hold the antenna leg in a latch position.

The antenna latch shown in Figures 2A-2C is simply one example of a latch structure that could be utilized to retain and hold the antenna 40 in a latched or retained position about the housing of the cellular telephone 10. It is appreciated that there are other latch designs that would be effective to retain and hold the antenna in a folded or stored position.

Turning to Figures 3 and 4, a second embodiment of the mobile telephone 10 is shown therein. The embodiment of Figures 3 and 4 is similar to that shown in Figures 1 and 2 with the exception that the antenna, indicated generally by the numeral 80, assumes a generally planar construction. More particularly, the foldable antenna 80 includes a first leg 82 that is directly coupled to a transverse pivot axis that extends across the rear portion of the top panel 12 of the telephone 10. Integrally formed with the first leg 82, which assumes a planar or panel type configuration, is a second leg 84 which also assumes a planar or panel type configuration. As seen in the drawings, the pair of panels 82 and 84 that constitute the antenna 80 are disposed in a generally L-shaped configuration. Note also that the antenna 80 includes a pair of opposed side rails 90 that, in the embodiment shown herein, are integral with the first and second legs or panels 82 and 84. Disposed on

opposite side edges of the front panel 18 is a pair of rail seats 92. The rail seats 92 are designed to accept the side rails 90 of the antenna such that when the antenna 80 assumes the retracted or folded position shown in Figure 3, the entire antenna fits cleanly around the top and front panels 12 and 18 of the telephone 10.

Thus, it is appreciated that the antenna 80 shown in the embodiment illustrated in Figures 3 and 4, is rotatable about a transverse axis between a retracted or folded position, shown in Figure 3, and an extended or operative position shown in Figure 4. It is appreciated that the antenna 80 can, by various conventional means, be biased to assume the retracted position shown in Figure 3. Also, shown in the embodiment of Figures 3 and 4 is a pushbutton actuator 94. The function of the pushbutton actuator 94 is to actuate a latch, such as the latch 100 shown in Figures 2A-2C, which engages the antenna 80 when the same assumes the retracted position shown in Figure 3. Thus, by pressing the actuator 94, such a latch would be released enabling the entire antenna 80 to rotate from the retracted position shown in Figure 3 to the extended or operative position shown in Figure 4.

Turning to Figures 5 and 6, another embodiment of the present invention is shown. In this embodiment, the mobile telephone 10 includes the same basic antenna construction shown in Figures 3 and 4 and described above. However, in addition to the movable or rotating antenna 80, the design or embodiment shown in Figures 5 and 6 shows a movable speaker unit 100. As seen in Figures 5 and 6, the speaker unit 100 is designed to move from a retracted position shown in Figure 5 to an extended and operative position shown in Figure 6. In the retracted position of Figure 5, the folding

antenna 80 is folded down and assumes its retracted position. There, the second leg or second panel 84 generally encompasses and covers the speaker unit 100 which is disposed about a speaker seat 102 that is formed about an upper corner portion of the front panel 18 of the cellular telephone 10. Consequently, speaker unit 100 is designed to move generally rectilinearly from the retracted position of Figure 5 to the extended position of Figure 6. Although not shown, speaker unit 100 can be designed to move up and down along one or more guides and can be spring biased to move towards the extended position in response to the actuation of a switch or in response to the selected movement of the antenna 80.

In Figures 7-11, another embodiment of the present invention is shown therein, and in this case both an antenna 120 and a speaker unit 132 are mounted about the housing of the telephone 10 for movement between retracted and extended positions.

Referring to the embodiment illustrated in Figure 7-11, the antenna 120 includes a first panel or leg 122 and a second panel or leg 124. Extending around both panels 122 and 124 is a perimeter run 126. The perimeter run 126 and the panels 122 and 124 are of an integral construction in the design illustrated in Figure 7-11.

Secured transversely across the top portion of the telephone housing is a pivot axis 128. Formed about an inner end of the antenna 120 adjacent a terminal edge of the first panel 122 is a pair of spaced apart collars 130. Each collar 130 includes an opening extending therethrough, with the opening being particularly sized to fit around pivot axis 128. The openings in the collars 130 can be sized such that the collars frictionally engage the pivot axis

128. In such a case, the entire antenna 120 can be rotated back and forth between the retracted position shown in Figure 8 and the extended position shown in Figure 11 in such a manner that the frictional fit existing between the collars 130 and the pivot axis 128 will maintain the antenna 120 in any set position between the retracted and extended positions. In addition, as pointed out above, various means can be incorporated and associated with the pivot axis 128 and collars 130 so as to bias the antenna 120 towards the extended position.

Also secured in coaxial arrangement with the antenna 120 is a speaker unit 132. In particular, the speaker unit 132 is rotatably mounted to the pivot axis 128. Speaker unit 132 includes a central collar 134 that includes an opening through which the pivot axis 128 extends. Extending from the collar 134 is a first panel 136. Extending from the first panel 136 is a second panel 138. Panels 136 and 138 constitute the frame structure of the speaker unit 132 and form a generally L-shaped configuration. Secured to the outer or terminal end of the second panel 138 is a speaker 140. Speaker 140 is pivotally connected to the second panel 138 via a transverse axis. Consequently, the speaker 140 can rotate about this transverse axis relative to the frame members 136 and 138, and the entire frame structure of the speaker unit 132 can rotate about the pivot axis 128.

As shown in Figure 7-11, it is seen that the speaker unit 132 is interposed intermediately between the antenna 120 and the front panel 18 of the telephone 10. In the retracted or inoperative position shown in Figure 8, it is seen that the speaker unit 132 is sandwiched between the antenna 120 and the front panel 18 of the cellular telephone 10. Note in this retracted

position, that the frame panels 136 and 138 extend over the top and front panels 12 and 18 of the telephone 10. The front panel 18, in the display area 18b, is formed with a cavity or depression that enables the speaker 140 to generally seat therein when the speaker unit 132 assumes the retracted position.

Also, in the retracted position shown in Figure 8, the antenna 120 extends over and generally covers the top 12 and front panel 18 of the telephone 10. Note that the first panel or first leg 122 extends over the top 12 of the telephone while the second panel or second leg 124 extends over the front panel 18 and generally covers the speaker 140 in the process.

In Figure 9, the antenna 120 is rotated clockwise to an intermediate position. Here, the speaker unit 132 remains in the retracted position. In Figure 10, the antenna 120 has been rotated clockwise to its full extended and operative position. The speaker unit 132 is shown rotated clockwise to an intermediate position. Finally, in Figure 11, both the antenna 120 and the speaker unit 132 have been rotated clockwise to their full extended positions. In this case, the antenna 120 extends outwardly and away from the telephone 10. When used by a person, it is appreciated that the antenna 120 would extend away from the person's head and, in the process, the phone 10 would be easier to use and at the same time the antenna 120 would be prone to operate more efficiently.

The speaker unit 132 can be adjusted by adjusting the frame of the speaker unit about the pivot axis 128 or by adjusting the speaker 140 about the transverse axis that couples the speaker 140 to the frame panels 136 and 138 of the speaker unit 132. In any event, by moving the speaker unit 132 to

an extended position, the distance between the speaker 140 and the microphone 20 is effectively increased and consequently, the speaker 140 can be positioned closer to the ear of the user while the microphone 20 can be positioned closer to the mouth of the user. This means that voice communications passing between the user and the telephone 10 can be transmitted more efficiently and with clarity.

In the foregoing specification and discussion, details of the mobile telephone 10 have not been disclosed because such is not per se material to the present invention and because basic mobile and cellular telephone technology is known and appreciated by those skilled in the art. In fact, cellular telephones of the general type discussed herein are manufactured by a number of companies including Ericsson, Inc. of Research Triangle Park, Raleigh, North Carolina. Further, details of antenna and speaker construction are well known by those ordinarily skilled in the art. Some patents have disclosed movable antennas and movable speakers as well as connectors for coupling such movable antennas and speakers to electrical components housed within the radiotelephone. For example, see the disclosures found in U.S. Patent Nos. 5,513,383; 5,461,672; 5,170,173; and 5,014,346. The disclosures of these four patents are expressly incorporated herein by reference.

The present invention may, of course, be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended Claims are intended to be embraced therein.

**CLAIMS**

What is claimed is:

1. A telephone having a folding antenna comprising: a housing having a top, front, back and two sides; a pivot axis secured transversely across the top portion of the telephone; an L-shaped antenna having first and second legs coupled to the telephone and rotatably mounted on the pivot axis for movement between a retracted position and an extended position; and, wherein in the retracted position the first leg lies adjacent the top of the housing while the second leg extends adjacent the front of the housing, and wherein in the extended position both the first and the second legs are rotated away from the top and front of the telephone housing.
2. The telephone of claim 1 wherein the first and second legs of the antenna are rigidly connected such that one leg is fixed with respect to the other leg.
3. The telephone of claim 1 wherein the legs of the L-shaped antenna comprise elongated antenna segments.
4. The telephone of claim 1 wherein at least one of the antenna legs comprises a generally planar antenna panel.
5. The telephone of claim 1 wherein the first and second legs of the antenna comprise first and second generally planar panels with the first panel overlying the top of the telephone housing and the second panel forming a cover overlying the front of the telephone housing when the antenna assumes the retracted position.



6. The telephone of claim 4 including a latch associated with the telephone for detachably connecting at least one panel of the antenna to a portion of the telephone housing.

7. The telephone of claim 6 including a latch associated with the telephone for connecting the second panel of the antenna in a position where the second panel overlies the front of the telephone housing.

8. The telephone of claim 7 wherein the latch includes a push button actuator extending from the housing of the telephone.

9. The telephone of claim 1 including a movable speaker unit that moves between a retracted position and an extended position.

10. The telephone of claim 9 wherein the speaker unit is movable about the same pivot axis that supports the L-shaped antenna.

11. The telephone of claim 9 wherein the telephone includes a main body portion and wherein the speaker unit is movable rectilinearly up and down relative to the main body of the telephone.

12. The telephone of claim 11 wherein in the retracted position the speaker unit forms an upper corner portion of the telephone and wherein in the extended position the speaker unit projects past the top of the housing.

13. The telephone of claim 9 wherein at least one of the legs of the antenna includes a panel that extends over the front of the housing and covers a substantial portion of the movable speaker unit when the antenna assumes the retracted position.

14. The telephone of claim 9 wherein the speaker unit includes a speaker frame and a speaker connected to the speaker frame, and wherein the speaker frame is connected to the telephone via the pivot axis that connects the L-shaped antenna to the telephone.

15. The telephone of claim 14 wherein the speaker is connected to the frame about a second pivot axis that extends generally parallel to the pivot axis that connects the L-shaped antenna to the telephone.

16. The telephone of claim 15 wherein the speaker frame assumes a generally L-shaped configuration such that in a retracted position the speaker frame overlies top and front portions of the telephone housing.

17. A telephone having a rotatable speaker unit comprising: a housing structure having a top, front, and a pair of sides; a pivot axis secured to the telephone; and a speaker unit rotatably mounted to the pivot axis and movable about the pivot axis from a retracted position to an extended position.

18. The telephone of claim 17 wherein at least a portion of the speaker unit assumes a generally L-shaped configuration.

19. The telephone of claim 18 including a housing structure that includes distinct surfaces and wherein in the retracted position the generally L-shaped speaker unit overlies portions of at least two distinct surfaces of the telephone.

20. The telephone of claim 19 wherein the pivot axis extends transversely across a top portion of the telephone and wherein in the retracted position the speaker unit assumes a position adjacent to and overlying portions of top and front of the telephone housing.

21. The telephone of claim 20 wherein the speaker unit includes an L-shaped frame and a speaker pivotally connected to the L-shaped frame, and wherein the L-shaped frame is pivotally connected to the pivot axis such that the speaker frame can be rotated between a retracted position where the same overlies a portion of the telephone housing structure and an extended

position where the speaker extends outwardly and away from the telephone, and wherein the orientation of the speaker can be adjusted relative to both the speaker frame and the telephone by pivoting the same about the axis that connects the speaker to the speaker frame.

22. The telephone of claim 17 including an antenna that is rotatable between a retracted position and an extended position and wherein in the retracted position the antenna assumes a position relatively close to the telephone housing while in the extended position the antenna assumes a position away from the telephone housing.

23. The telephone of claim 22 wherein the rotatable antenna assumes a generally L-shaped configuration and includes a first leg and a second leg.

24. The telephone of claim 23 wherein the antenna and speaker unit are coaxially mounted about the pivot axis.

25. The telephone of claim 24 wherein the antenna comprises at least one panel and wherein in the retracted position the panel assumes a position overlying both the speaker unit and the front of the telephone housing.

26. A telephone comprising:

(a) a housing structure having a top, a pair of sides, back, and a front including a key pad area;

(b) a pivot axis formed on the telephone;

(c) a speaker unit rotatably mounted on the pivot axis and rotatable between a retracted position and an extended position;

(d) the speaker unit including a frame and a speaker pivotally connected to the frame, and wherein the frame is in turn rotatably mounted on the pivot axis;

(e) an antenna coaxially mounted on the pivot axis with the speaker unit and movable between a retracted position where the antenna assumes a position relatively close to the telephone housing and an extended position where the antenna extends outwardly from the housing; and

(f) wherein the antenna includes a panel that, in the retracted position, assumes a position over the front of the telephone housing while the speaker assumes a position sandwiched between the panel and the front of the telephone housing.

27. The telephone of claim 26 wherein both the antenna and speaker unit assume a generally L-shaped configuration and wherein in the retracted position both the antenna and the speaker unit overlie portions of the top and front of the telephone housing with the antenna being disposed outwardly of the speaker unit such that in the retracted position the antenna overlies the speaker unit.

28. The telephone of claim 27 wherein the pivot axis extends transversely across the top portion of the telephone.

29. The telephone of claim 28 wherein the telephone includes a top-back edge portion that lies generally between the top and back of the telephone housing and wherein the pivot axis is disposed generally along the top-back edge portion of the telephone.

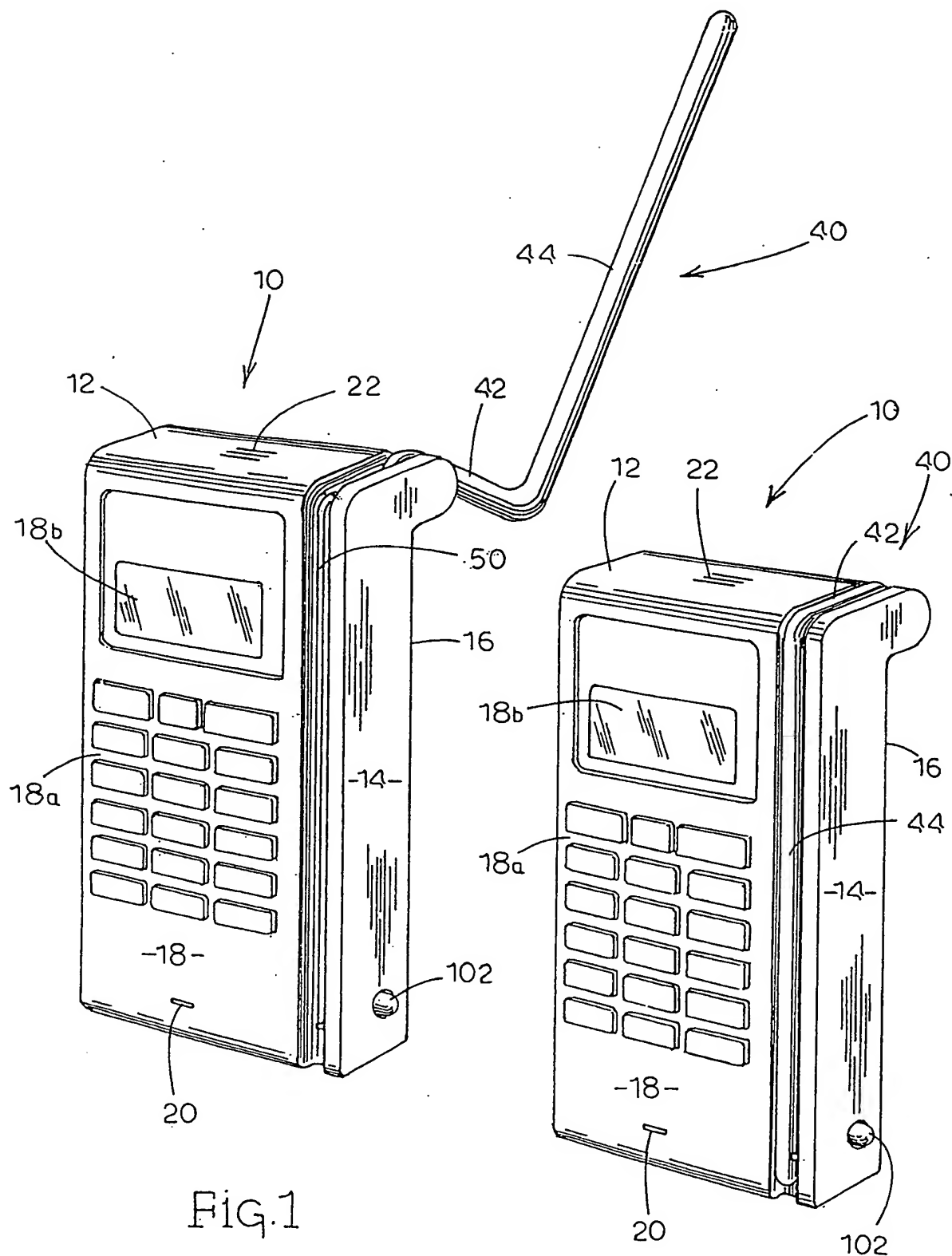


Fig.1

Fig.2

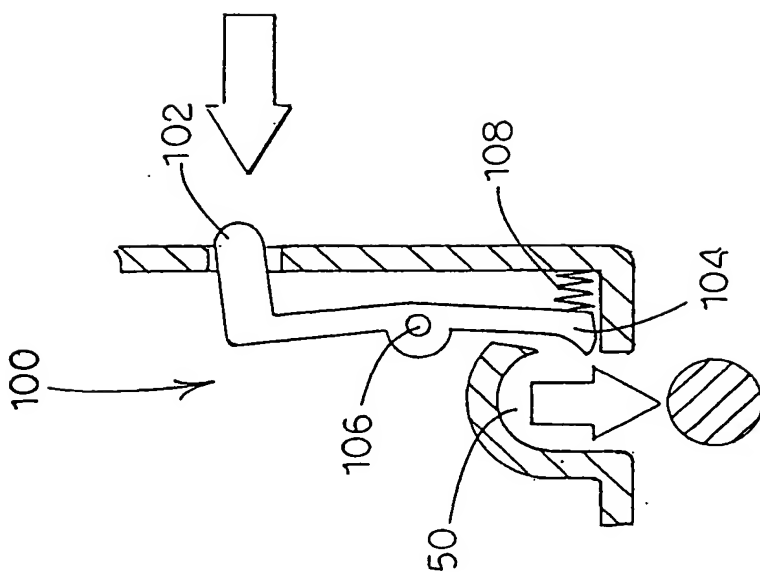


Fig. 2C

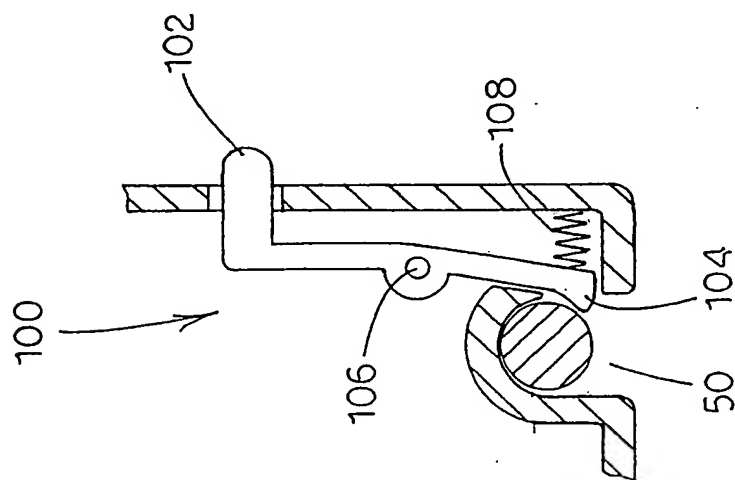


Fig. 2B

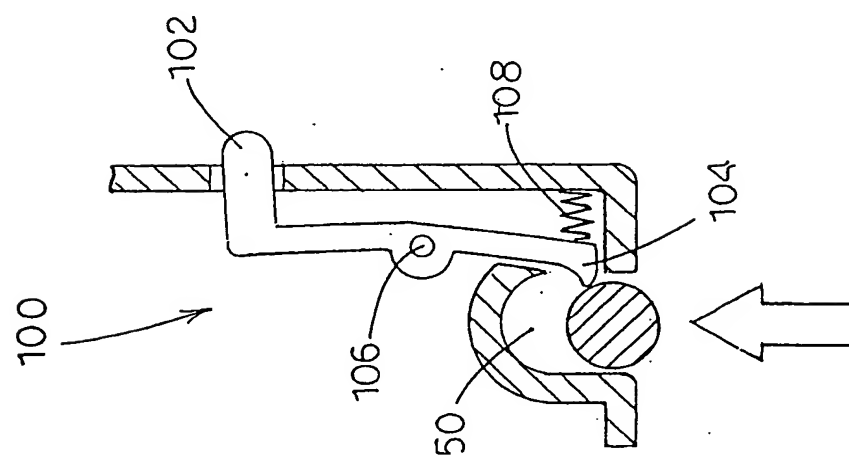
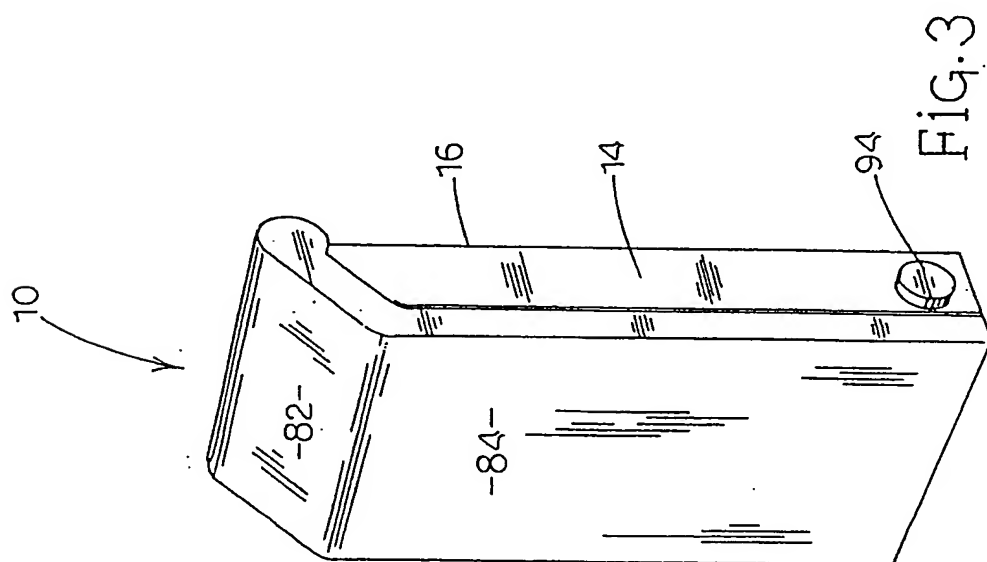
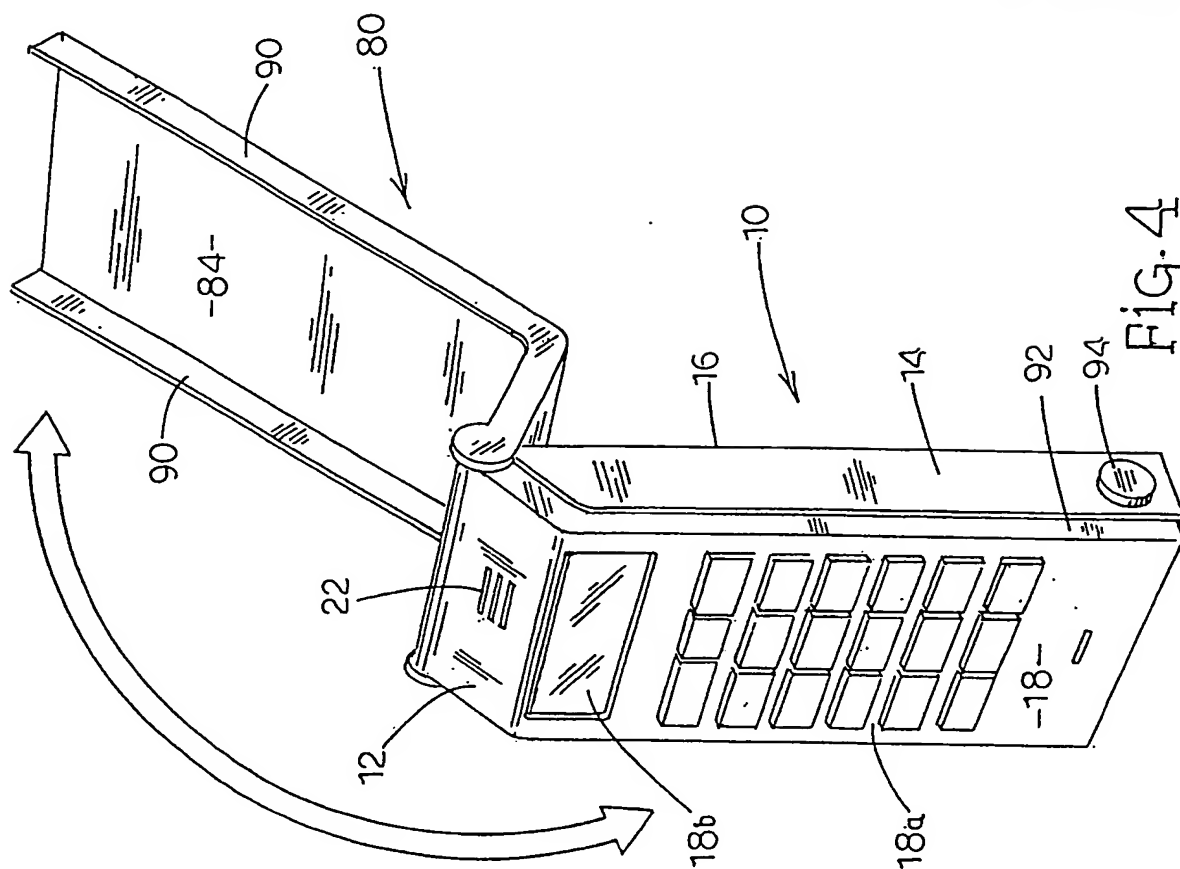


Fig. 2A



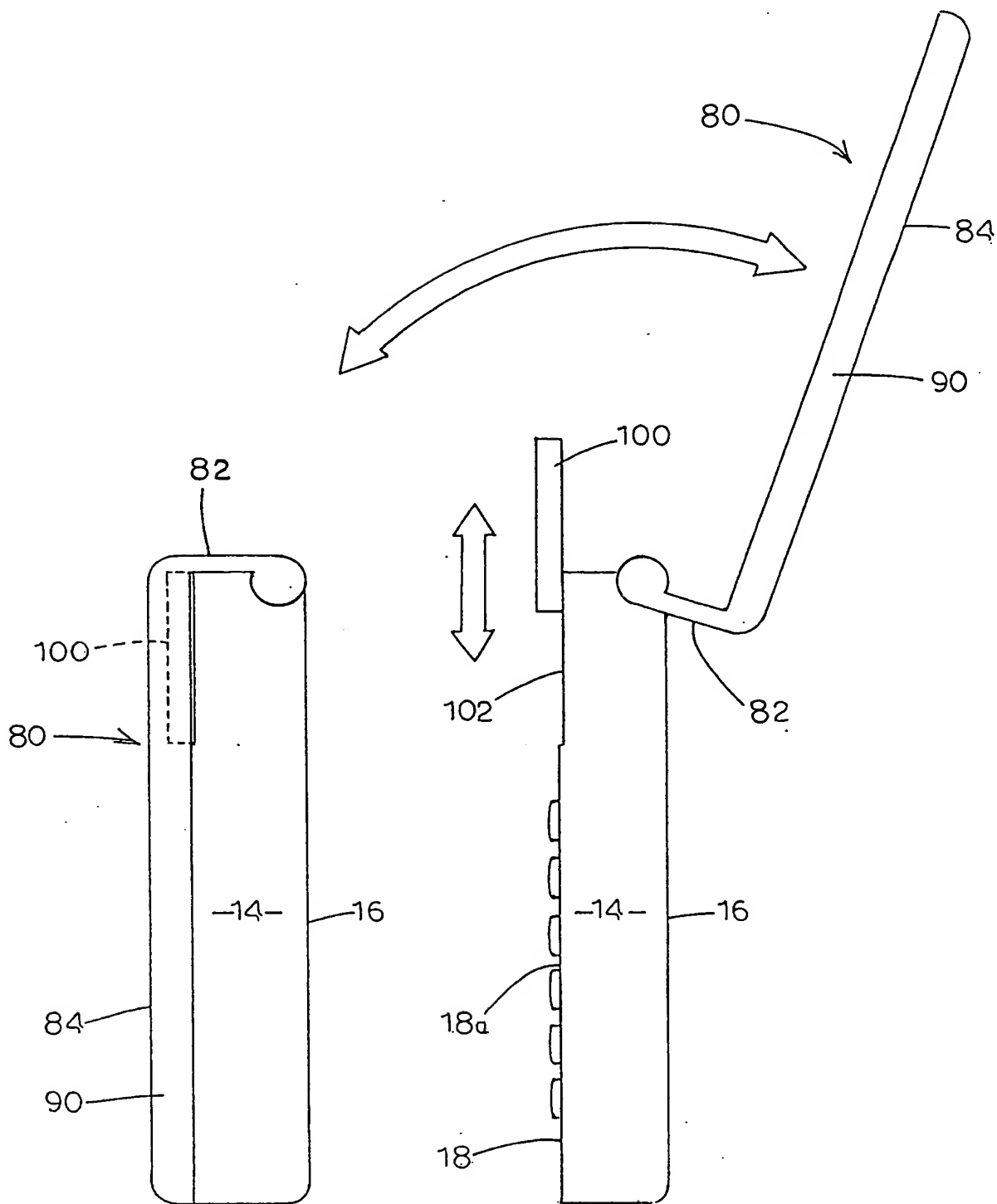


Fig. 5

Fig. 6



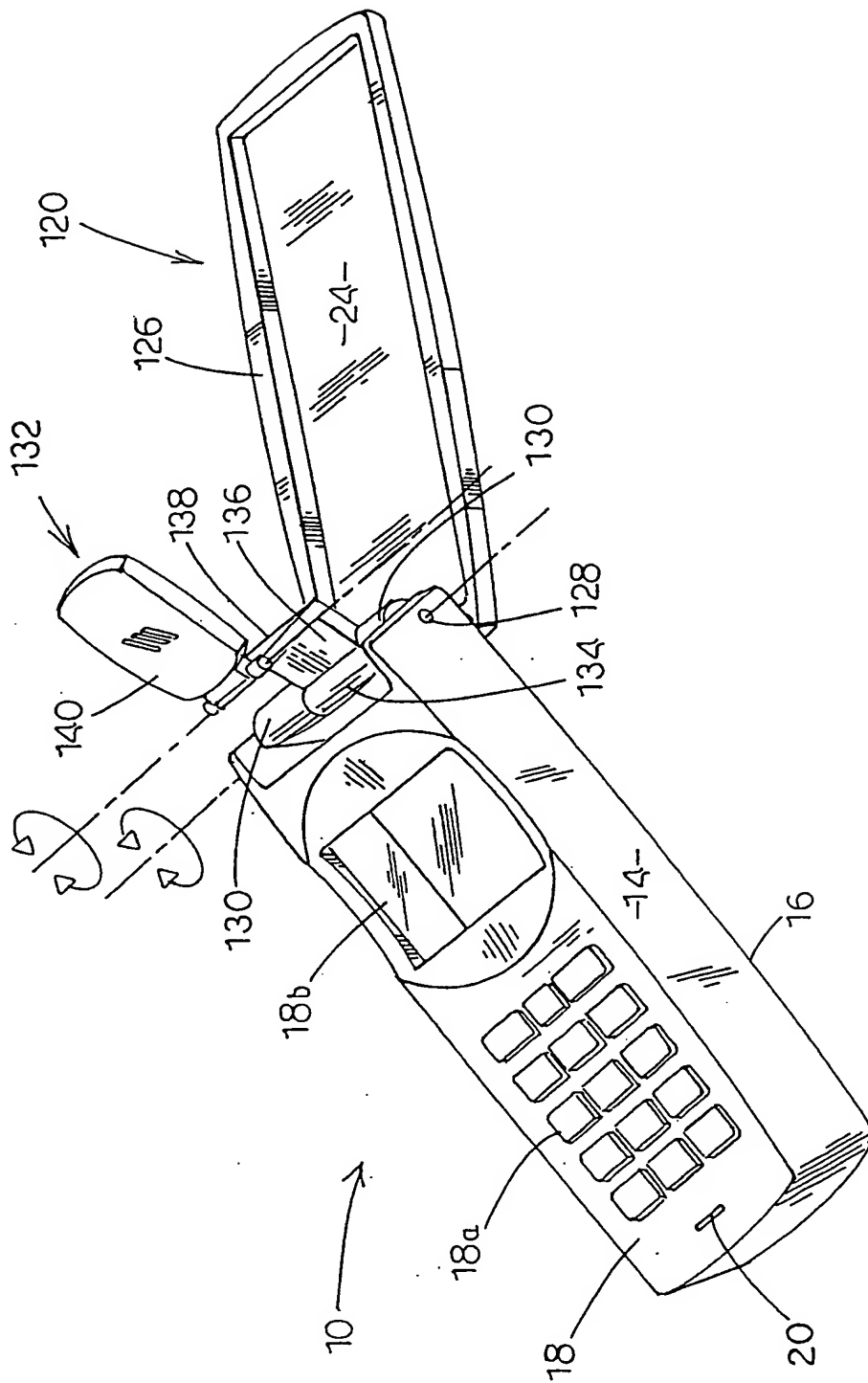


FIG. 7

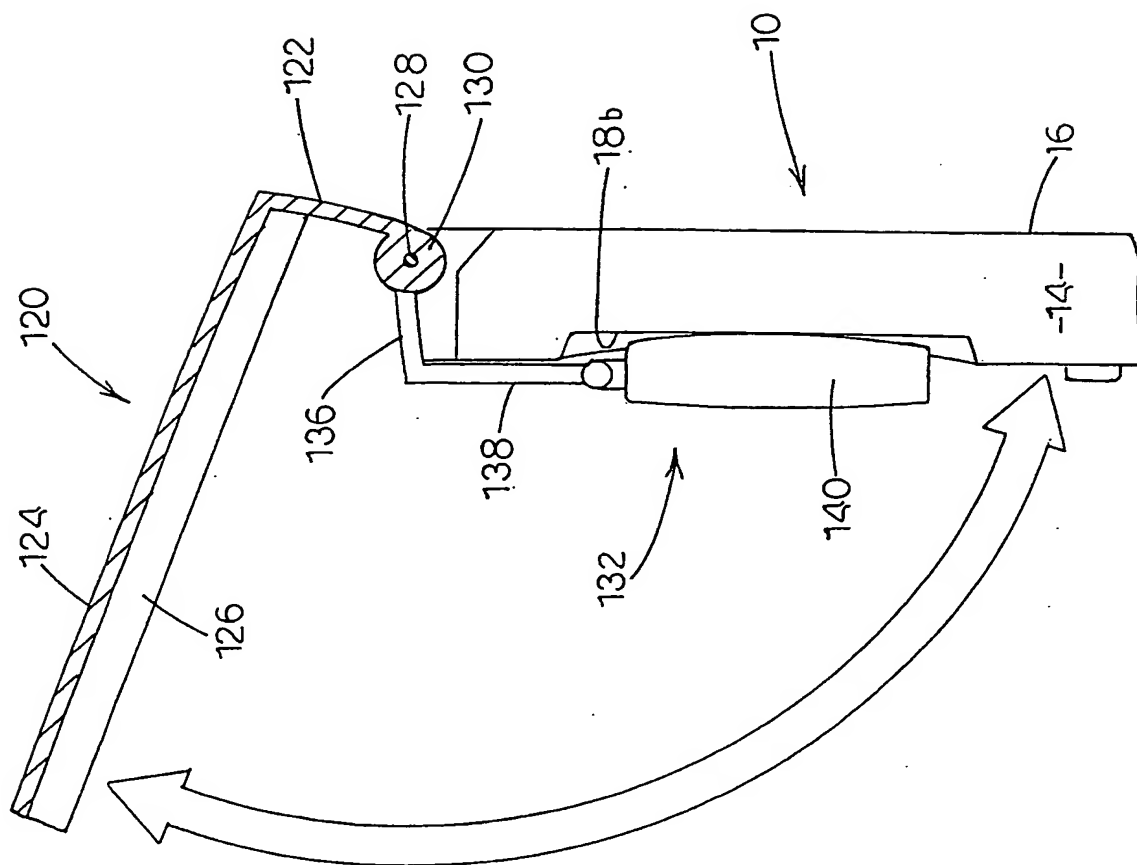


Fig. 8

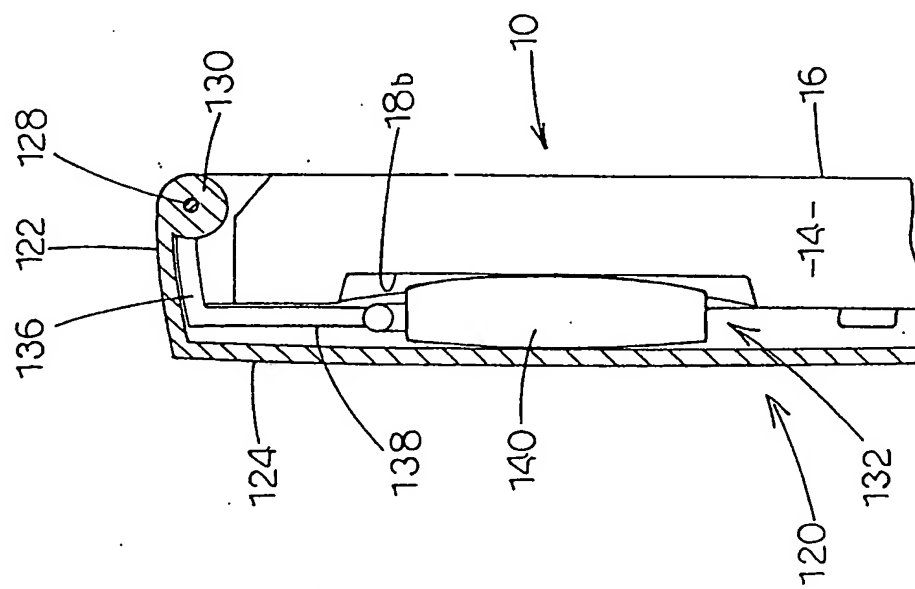


Fig. 9

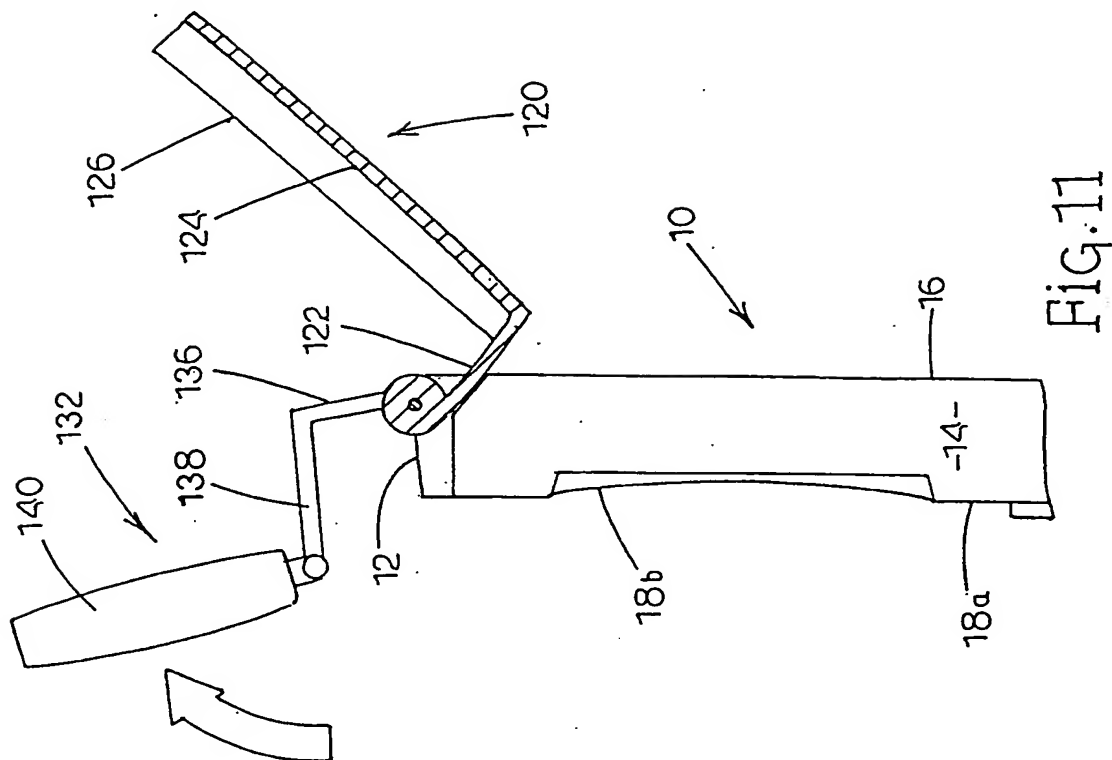


Fig. 11

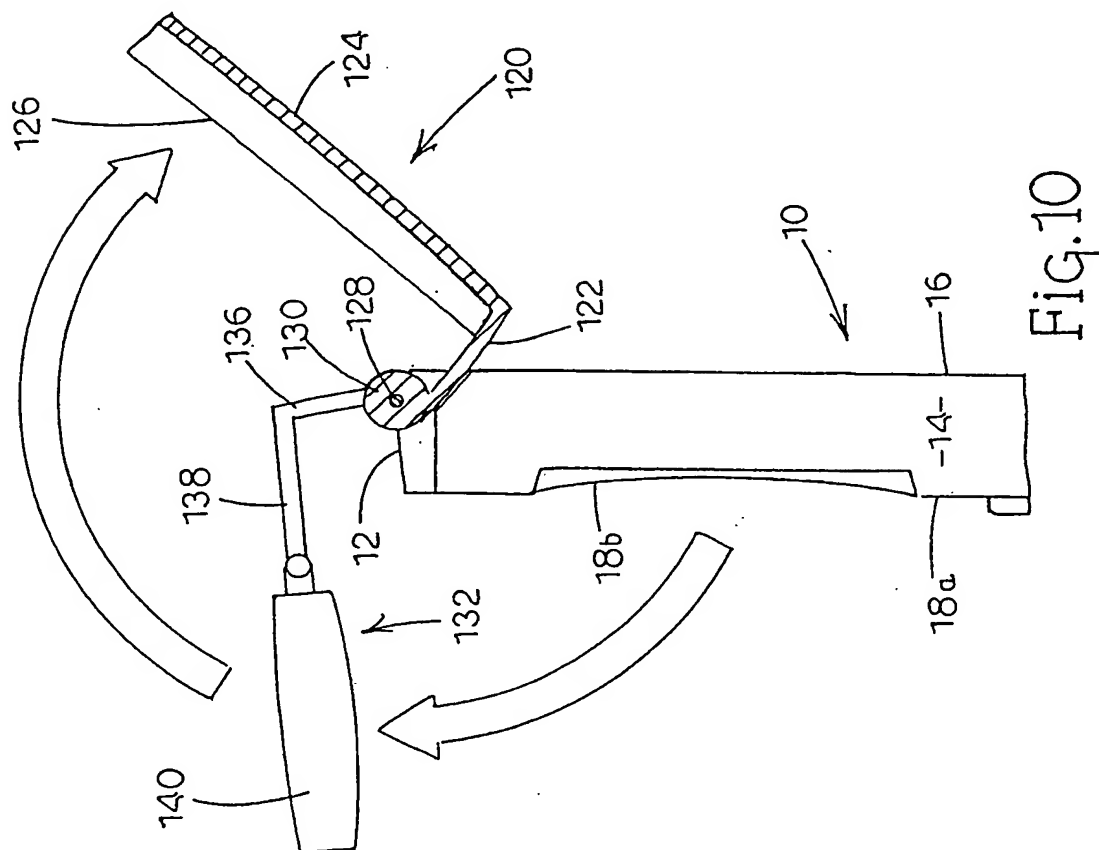
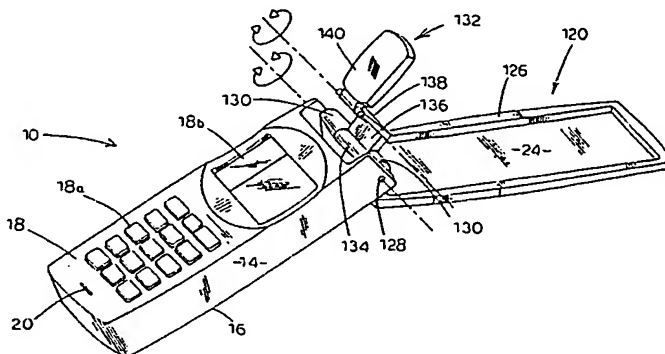


Fig. 10

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification 7 :</b> <b>H04B 1/38, H04M 1/02, H01Q 1/24, 1/08</b>	<b>A3</b>	<b>(11) International Publication Number:</b> <b>WO 00/19625</b> <b>(43) International Publication Date:</b> 6 April 2000 (06.04.00)
<b>(21) International Application Number:</b> PCT/US99/21698 <b>(22) International Filing Date:</b> 20 September 1999 (20.09.99) <b>(30) Priority Data:</b> 09/161,183                      25 September 1998 (25.09.98)      US <b>(71) Applicant:</b> ERICSSON, INC. [US/US]; 7001 Development Drive, Research Triangle Park, NC 22709-3969 (US). <b>(72) Inventor:</b> RYDBECK, Nils, R., C.; 202 Rutherglen, Cary, NC 27511 (US). <b>(74) Agent:</b> COATS & BENNETT, P.L.L.C.; Post Office Box 5, Raleigh, NC 27602 (US).		<b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i>  <b>(88) Date of publication of the international search report:</b> 6 July 2000 (06.07.00)
<b>(54) Title: MOBILE TELEPHONE HAVING A FOLDING ANTENNA</b>  <b>(57) Abstract</b>  <p>A mobile telephone having a movably mounted antenna and speaker. The mobile telephone includes a housing structure having a top, a pair of sides, back and a front panel including a keypad area and a display. Formed about a top portion of the telephone is a transverse axis. Rotatably mounted in coaxial relationship to the transverse axis is an L-shaped antenna and a speaker unit. In a retracted position, both the antenna and the speaker unit assume a retracted position where the speaker is disposed adjacent the front panel of the telephone while the antenna overlies the speaker. In an extended position, both the antenna and the speaker unit are moved away from the front panel of the telephone and the speaker unit is normally disposed inwardly of the antenna.</p>		



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# INTERNATIONAL SEARCH REPORT

Inter. Application No

PCT/US 99/21698

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 H04B1/38 H04M1/02 H01Q1/24 H01Q1/08

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 H04B H04M H01Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 26714 A (ERICSSON GE MOBILE INC) 24 July 1997 (1997-07-24) page 5, line 9 -page 6, line 10; claims 1,11; figures 1,2	1-5
Y		9,11,12, 14,23 10
A		
X	WO 94 13088 A (MOTOROLA INC) 9 June 1994 (1994-06-09) page 4, line 3 -page 6, line 17 page 12, line 2 -page 15, line 21 page 19, line 23 -page 24, line 10; figures 1-6	17,18,22
Y		9,11,12, 14,23 26
A		

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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- "&" document member of the same patent family

Date of the actual completion of the international search

13 April 2000

Date of mailing of the international search report

19. 04. 2000

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## INTERNATIONAL SEARCH REPORT

Int. Application No

PCT/US 99/21698

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 308 938 A (MOTOROLA INC) 9 July 1997 (1997-07-09) page 3, line 29 -page 4, line 26; figures 1,2	17
A	----	26
A	US 5 809 403 A (MA YAWEI ET AL) 15 September 1998 (1998-09-15) column 3, line 8 -column 4, line 56; figure 1	1
A	----	1
A	EP 0 036 442 A (BOSCH GMBH ROBERT) 30 September 1981 (1981-09-30) page 2, line 23 -page 4, line 7; figure 1	1
A	----	1
A	US 5 535 435 A (BALZANO QUIRINO ET AL) 9 July 1996 (1996-07-09) the whole document	1
A	----	1
A	EP 0 644 607 A (LORAL SPACE SYSTEMS INC) 22 March 1995 (1995-03-22) column 3, line 9-42; figures 1,2	1
A	----	1
A	EP 0 694 985 A (MOTOROLA INC) 31 January 1996 (1996-01-31) column 2, line 16-47; figure 2	1
	-----	

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US 99/21698

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☒ No protest accompanied the payment of additional search fees.



FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-8

latch

2. Claims: 9-29

speaker

# INTERNATIONAL SEARCH REPORT

Information on patent family members

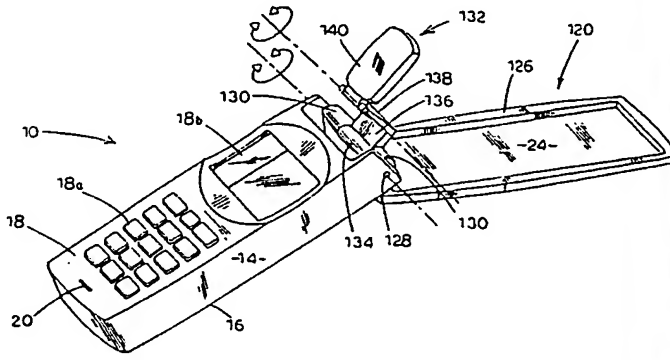
Inter. Patent Application No

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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>7</sup> :</b> <b>H04B 1/38, H04M 1/02, H01Q 1/24, 1/08</b>	<b>A3</b>	<b>(11) International Publication Number:</b> <b>WO 00/19625</b> <b>(43) International Publication Date:</b> 6 April 2000 (06.04.00)
<b>(21) International Application Number:</b> PCT/US99/21698 <b>(22) International Filing Date:</b> 20 September 1999 (20.09.99) <b>(30) Priority Data:</b> 09/161,183 25 September 1998 (25.09.98) US <b>(71) Applicant:</b> ERICSSON, INC. [US/US]; 7001 Development Drive, Research Triangle Park, NC 22709-3969 (US). <b>(72) Inventor:</b> RYDBECK, Nils, R., C.; 202 Rutherglen, Cary, NC 27511 (US). <b>(74) Agent:</b> COATS & BENNETT, P.L.L.C.; Post Office Box 5, Raleigh, NC 27602 (US).		<b>(81) Designated States:</b> AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>With amended claims and statement.</i>  <b>Date of publication of the amended claims and statement:</b> 10 August 2000 (10.08.00)
<b>(54) Title:</b> MOBILE TELEPHONE HAVING A FOLDING ANTENNA  <b>(57) Abstract</b>  A mobile telephone having a movably mounted antenna and speaker. The mobile telephone includes a housing structure having a top, a pair of sides, back and a front panel including a keypad area and a display. Formed about a top portion of the telephone is a transverse axis. Rotatably mounted in coaxial relationship to the transverse axis is an L-shaped antenna and a speaker unit. In a retracted position, both the antenna and the speaker unit assume a retracted position where the speaker is disposed adjacent the front panel of the telephone while the antenna overlies the speaker. In an extended position, both the antenna and the speaker unit are moved away from the front panel of the telephone and the speaker unit is normally disposed inwardly of the antenna.  		

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## AMENDED CLAIMS

[received by the International Bureau on 19 June 2000 (19.06.00);  
original claims 1-29 replaced by new claims 1-17 (4 pages)]

1. A telephone having a folding antenna, comprising:  
a housing having at least a top, a front, a back and two sides;  
a first pivot axis disposed transversely across said top portion of the telephone;  
an L-shaped antenna having first and second legs coupled to the telephone and rotatably mounted for movement about said first pivot axis between a retracted position wherein said first leg lies adjacent said top of said housing and said second leg extends adjacent said front of said housing and an extended position wherein both said first and second legs are rotated away from the top and front of the telephone housing; and  
a speaker unit moveably connected to said housing, said speaker unit moveable between a retracted position and an extended position.
2. The telephone of claim 1 wherein said speaker unit is movably connected to said housing for movement about said first pivot axis.
3. The telephone of claim 1 wherein said housing further includes a main body portion and wherein the speaker unit is movably connected to said housing for movement rectilinearly relative to said main body.
4. The telephone of claim 3 wherein said speaker unit forms an upper corner portion of the telephone in the retracted position and wherein said speaker unit projects past said top of said housing in the extended position.

AMENDED SHEET (ARTICLE 19)

5. The telephone of claim 1 wherein at least one of the legs of the antenna includes a panel that extends over the front of the housing and covers a substantial portion of the movable speaker unit when the antenna assumes the retracted position.

6. The telephone of claim 1 wherein the speaker unit includes a speaker frame and a speaker connected to the speaker frame, and wherein the speaker frame connects to the telephone via said first pivot axis.

7. The telephone of claim 6 wherein the speaker connects to the frame about a second pivot axis that extends generally parallel to said first pivot axis.

8. The telephone of claim 7 wherein the speaker frame assumes a generally L-shaped configuration such that in a retracted position the speaker frame overlies top and front portions of the telephone housing.

9. A telephone having a rotatable speaker unit, comprising:  
a housing having at least a top, a front, a back and two sides;  
a first pivot axis disposed transversely across said top portion of the telephone;

a speaker unit rotatably connected to said housing, said speaker unit rotatable about said first pivot axis between an extended position and a retracted position wherein the speaker unit assumes a position adjacent to and overlying portions of said top and front of said housing;

wherein at least a portion of the speaker unit assumes a generally L-shaped configuration.

10. The telephone of claim 9 wherein said speaker unit includes an L-shaped frame and a speaker pivotally connected to the L-shaped frame about

a second pivot axis, said L-shaped frame pivotally connected to said housing for movement about said first pivot axis between a retracted position where said L-shaped speaker frame overlies a portion of said housing and an extended position where the speaker extends outwardly and away from said housing, and wherein the orientation of the speaker can be adjusted relative to both the speaker frame and the housing by pivoting the same about the second pivot axis.

11. The telephone of claim 9 including an antenna that is rotatable about said first pivot axis between a retracted position relatively close to said housing and an extended position away from said housing.

12. The telephone of claim 11 wherein said rotatable antenna includes a first leg and a second leg and assumes a generally L-shaped configuration.

13. The telephone of claim 12 wherein the antenna comprises at least one panel that assumes a position overlying both the speaker unit and the front of the housing in the retracted position.

14. A telephone comprising:

- a housing structure having a top, a pair of sides, back, and a front including a key pad area;
- a pivot axis formed on the telephone;
- a speaker unit rotatably mounted on the pivot axis and rotatable between a retracted position and an extended position;
- the speaker unit including a frame and a speaker pivotally connected to the frame, and wherein the frame is in turn rotatably mounted on the pivot axis;

an antenna coaxially mounted on the pivot axis with the speaker unit and movable between a retracted position where the antenna assumes a position relatively close to the telephone housing and an extended position where the antenna extends outwardly from the housing; and

wherein the antenna includes a panel that, in the retracted position, assumes a position over the front of the telephone housing while the speaker assumes a position sandwiched between the panel and the front of the telephone housing.

15. The telephone of claim 14 wherein both the antenna and speaker unit assume a generally L-shaped configuration and wherein in the retracted position both the antenna and the speaker unit overlie portions of the top and front of the telephone housing with the antenna being disposed outwardly of the speaker unit such that in the retracted position the antenna overlies the speaker unit.

16. The telephone of claim 15 wherein the pivot axis extends transversely across the top portion of the telephone.

17. The telephone of claim 16 wherein the telephone includes a top-back edge portion that lies generally between the top and back of the telephone housing and wherein the pivot axis is disposed generally along the top-back edge portion of the telephone.



**STATEMENT UNDER ARTICLE 19(1)**

Pursuant to Article 19(1) the claims have been amended. In particular:

Claims 1 through 8 have been deleted.

Claim 9 has been put in independent form and renumbered as claim 1.

Claims 10 through 12 have been reworded slightly for clarity and renumbered as claims 2 through 4.

Claim 13 has been renumbered as claim 5.

Claims 14 through 15 have been reworded slightly and renumbered as claims 6 through 7.

Claim 16 has been renumbered as claim 8.

Claims 17 through 19 have been deleted.

Claim 20 has been put in independent form (not including the limitations of old claim 19) and renumbered as claim 9.

Claims 21 through 23 have been reworded slightly and renumbered as claims 10 through 12.

Claim 14 has been deleted.

Claim 25 has been reworded slightly for clarity and renumbered as claim 13.

Claims 26 through 29 have been renumbered as claim 14 through 17.

Enclosed please find replacement pages 14 through 17.

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